

YEAR END REVIEW-2020: DST, M/O SCIENCE & TECHNOLOGY

Relevant for: Science & Technology | Topic: Achievements of Indians in science & technology

Major Highlights: 20 Major Success Stories of DST in 2020

The major challenges that 2020 put before the world helped India emerge as a forerunner in underscoring the critical role of science and technology in bringing positive transformations for a safe, secure, better society well prepared for the future. The country pole-vaulted into one of the top nations in science & technology indices and reached laudable positions in several domains of science technology and innovations.

The year 2020 has been the 'Year of Science' when the best of humanity has shone through the gloom that descended upon us due to the COVID19 pandemic. It is a matter of record that as the spread of the disease accelerated, so did the research efforts to mitigate this. -[Minister for Science & Technology, Earth Sciences, Health & Family Welfare Dr. Harsh Vardhan](#)

Science and technology is one of the most powerful departments of the country for solving all kinds of problems - agriculture, potable water, energy, health and so on. -- [Minister for Science & Technology, Earth Sciences, Health & Family Welfare Dr. Harsh Vardhan](#)

Science and Technology are the strongest foundations on which the future can be built. India is progressing rapidly towards self reliance by connecting the invention ecosystem to the innovation ecosystem with democratisation and diversity of science becoming the drivers of development. --[Secretary, Department Of Science & Technology, Professor Ashutosh Sharma](#)

India is placed 3rd among countries in scientific publication as per NSF database. The country has featured within the top 50 innovative economies globally (at 48th rank), as per Global Innovation Index (GII). It has also reached 3rd Position in terms of no of PhDs, in size of Higher Education System; as well as in terms of No of Startups.

India has emerged as an inevitable member of leading international scientific coalitions— notably, global efforts in vaccine research, development and supply, and global partnership on artificial intelligence (GPAI) to name a few. India was elected as Chair of the World Health Organization's (WHO) executive board which is a yet another remarkable achievement and recognition of India's S&T prowess.

The draft of the 5th National Science Technology and Innovation Policy has been finalized and is now available for public consultation. The policy drafted through a 4

track process of consultations during last 6 months aims to bring about profound changes through short, medium and long-term mission mode projects by building an nurtured ecosystem that promotes research and innovation on the part of both individuals and organizations.

It aims to foster, develop, and nurture a robust system for evidence and stakeholder-driven STI planning, information, evaluation, and policy research in India. The objective of the policy is to identify and address strengths and weaknesses of the Indian STI ecosystem to catalyse socio-economic development of the country and also make the Indian STI ecosystem globally competitive.

'Science' and 'Science-Advice' became the core of decision making. The share of scientific and science-informed debates in mainstream media jumped manifold, and the confidence of general population and trust in Science & Technology increased significantly.

Seamless industry-academia collaborations and inter-disciplinary partnerships led to quicker solutions and products in an energised STI ecosystem in 2020.

The National Initiative for Developing and Harnessing Innovation (NIDHI) made some major impacts on India's Innovation ecosystem by nurturing 3,681 startups through a network of 153 incubators created by DST, which generated 65,864 jobs as cumulative direct employment, created a wealth of Rs 27,262 crores and generated 1,992 intellectual property.

The "Million Minds Augmenting National Aspirations and Knowledge (MANAK)" programme brought 3.8 mn ideas from middle and high schools across the country, out of which some brilliant ones have been shortlisted for showcasing at district, state and then at the National Level Exhibition & Project Competition.

The collective strength and power of NIDHI, its incubator network and its startups was tested successfully during the COVID-19 pandemic through the "**Centre for Augmenting WAR with COVID-19 Health Crisis (CAWACH)**" program by supporting various solutions to resolve the crisis. The efforts of CAWACH to scout, evaluate and support the innovations and startups that address COVID-19 challenges led to a slew of technologies, diagnostics & drugs, disinfectants & sanitizers, ventilators & medical equipment, PPEs and informatics as solutions to contain, treat and manage the pandemic.

India National Supermodel Committee predicted the rise and fall of the pandemic over time. The modelling study called the 'COVID-19 India National Supermodel' deduced that India passed its COVID-19 peak in September and, if current trends continue, there will be 'minimal cases' by February.

However, they warned that there is no place for complacency and existing personal safety protocols need to continue in full measure. The deduction is the result of analysis by an expert committee consisting of mathematicians and epidemiologists.

The National Super Computing Mission (NSM) is rapidly boosting High-Performance Computing (HPC) in the country to meet the increasing computational demands of academia, researchers, MSMEs, and startups in oil exploration, flood prediction, genomics, and drug discovery. Param Shivay, the first supercomputer assembled indigenously, was installed in IIT (BHU), followed by Param Shakti and Param Brahma at IIT-Kharagpur and IISER, Pune, respectively. Thereafter facilities were set up in two more institutions, and MoUs signed for providing it to 13 institutions. Param Siddhi the high-performance computing-artificial intelligence (HPC-AI) achieved global ranking of 63 among the top 500 most powerful non-distributed computer systems.

Sophisticated Analytical & Technical Help Institutes (SATHI) centres to house major analytical instruments have been established to provide common services of high-end analytical testing, thus reducing dependency on foreign sources. The ST has set up three such centres—at IIT Kharagpur, IIT Delhi and BHU under the SATHI programme which are being operated with a transparent, open-access policy to make professionally managed, S&T infrastructure readily accessible to academia, start-ups, industry and R&D labs. Five SATHI centres every year have been planned for the next four years.

New S&T areas of Cyberphysical systems like AI, Robotics, IOT receive big boost with the launch of the National Mission on Interdisciplinary Cyber-Physical Systems (ICPS). Its unique architecture of 25 innovation hubs and parks set up across the country is bringing about strong collaboration and co-ownership among industry, academia, and government, connecting them with full flexibility.

Three Centres of Excellence (CoE) were established in Himalayan Universities in Kashmir, and North Eastern States of Sikkim & Assam to lead climate change research. Research on monsoons, aerosols, glacial lake outburst floods saw significant publications. A study published in journal Science showed planetary wave from the North Atlantic is capable of derailing the Indian monsoon. Research published in the journal Atmospheric Chemistry and Physics' showed that aerosols increased incidents of high rainfall in the Himalayan foothills.

12. CELEBRATION OF SCIENCE INVITES ATTENTION OF TOP DIGNITARIES

President of India Ram Nath Kovind announced three key initiatives for gender advancement and equality in academic and research institutions on occasion and conferred national awards for science communication and popularization, including women excellence awards.

President of India graced the celebration of the National Science Day (NSD) for the first time. NSD is celebrated on 28th February to commemorate the announcement of the discovery of the 'Raman Effect' by Sir C.V. Raman for which he was awarded the Nobel Prize in 1930.

Gender Advancement for Transforming Institutions (GATI), an innovative pilot project

launched by the DST ushered a novel intervention for promoting gender equity in science and technology. It nudges institutions of higher education and research towards supporting diversity, inclusion and the full spectrum of talent for their own success and progression. In particular, it aspires to create an enabling environment for equal participation of women in Science, Technology, Engineering, Medicine and Mathematics (STEMM) disciplines at all levels.

14. SRI CHITRA'S PROACTIVE EFFORTS HELP COMBAT THE PANDEMIC

Sree Chitra Tirunal Institute for Medical Sciences and Technology (SCTIMST) brought out several technologies and products that could be crucial to combat the diseases.

It's one step confirmatory diagnostic kit for COVID 19 that responded to India's urgent need for rapid testing. The other R&D work on the issue included a UV Based Facemask Disposal Bin, which can be used by health workers in hospitals and in public places for decontamination of used facemask, overhead covers and face shields, a superabsorbent material for liquid respiratory and other body fluid solidification and disinfection for the safe management of infected respiratory secretions.

15. SURVEY OF INDIA LAUNCHED PAN INDIA HIGHRESOLUTION GEOSPATIAL MAPPING

The Survey of India (Sol), a subordinate department under the Department of Science & Technology has embarked on a pan-India geospatial mapping of the country at a very high resolution of 10 cm scale using most advanced technologies like drone technology. With this, India joins the select club of few nations to have Ultra High-resolution National Topographic Data as foundation data.

This effort has been launched in three States -- Haryana, Maharashtra, and Karnataka and also for the Ganga basin. Sol has undertaken mapping of the Village Gaothan (Aabadi) areas in Maharashtra, covering more than 40,000 villages. Drone-based mapping for five districts of the state of Karnataka for the revenue department, including the village, semiurban and urban areas, and LSM mapping for the complete state of Haryana has also been undertaken.

Drone survey will be pivotal to fix locations of village boundaries, canals, canal limits, agriculture field limits, and roads in these villages.

Sol has also launched web portals to facilitate the access of the digital map or data to every citizen of the country and help centre and state organizations in decision making, planning, monitoring, and governance. Sol has also provided a free to use mobile app, "SAHYOG".

16. SERB LAUNCHES POWER FOR WOMEN RESEARCHERS

Science and Engineering Research Board (SERB), a Statutory body of the Department of Science and Technology (DST), Government of India, initiated a Scheme to mitigate gender disparity in science and engineering research funding in Indian academic institutions and R&D laboratories. A well-thought-out Scheme titled “SERB-POWER (Promoting Opportunities for Women in Exploratory Research)” has been designed exclusively for women scientists and was launched on 29 October 2020. SERB-POWER promotes women researchers in regular service in academic and research institutions to take up R&D at the highest level through two categories of research support, namely, SERB – POWER Fellowship and SERB – POWER Research Grants.

SERB – Power Fellowship offers a personal Fellowship and a research grant to top performing women researchers for a period of three years, while SERB – Power Research Grants ensure funding to undertake highly impactful research across all disciplines of S&T. Call for projects for this program is already announced.

17. PHENOMENAL WHITE PAPER BY TIFAC PROVIDED RECOMMENDATIONS FOR FOCUSED INTERVENTIONS FOR ‘MAKE IN INDIA AFTER THE COVID 19 PANDEMIC

A phenomenal white paper on “Focused Interventions for ‘Make in India’: Post COVID 19” prepared by Technology Information, Forecasting and Assessment Council (TIFAC) provided recommendations for giving immediate technology and policy impetus to make India “ATMANIRBHAR,” specially in the aftermath of the pandemic. It captured sector-specific strengths, market trends, and opportunities in five sectors, critical from the country’s perspective, including healthcare, machinery, ICT, agriculture, manufacturing, and electronics with reference to supply and demand, self-sufficiency, and mass-scale production capacity. It has identified policy options primarily in the public health system, MSME sector, global relations: FDI, recalibrated trade alignments, new-age technologies, etc.

18. SCIENTISTS FROM IIA & ARIES COLLABORATED WITH NOBEL LAUREATE ON TMT

Indian astronomers have worked with 2020 Physics Nobel Laureate Prof. Andrea Ghez on the design of backend instruments and possible science prospects of the Thirty Meter Telescope (TMT) project being installed at Maunakea in Hawaii which can revolutionize the understanding of the universe and the enigmas in it. Scientists from the Indian Institute of Astrophysics (IIA) and Aryabhata Research Institute of Observational Sciences (ARIES) have collaborated with Prof. Ghez in the ongoing research and developmental activities of the TMT project.

19. BSIP SCALES UP COVID TESTING FACILITIES, BECOMING THE TOP INSTITUTION THROUGHOUT THE COUNTRY IN TERMS OF AVERAGE PROCESSING TIME OF SAMPLES

BSIP joined hands with the Government of Uttar Pradesh to combat COVID-19 in the state, becoming one of the five Central Government research institutes in Lucknow,

which took initial steps to start laboratory testing of COVID-19. With 1000 to 1200 samples being tested per day, BSIP is the top institution not only in the state but throughout the country in terms of the average processing time of samples.

20. RRI ACHIEVES FIRST SUCCESSFUL IMPLEMENTATION OF A HIGHLY SECURE EFFICIENT QUANTUM CRYPTOGRAPHIC SCHEME

The QuIC lab at RRI achieved the first successful implementation in India of a highly secure efficient Quantum Cryptographic scheme for an end to end free space QKD under the RRI-ISRO project on “Quantum Experiments using Satellite Technology”. The lab has also come up with an end-to-end simulation toolkit named as “qkdSim” to ensure safety in secure quantum communication platforms, a first of its kind that enables Quantum Key Distribution Protocol (QKD) experimentalists to obtain a realistic estimate of the result from an experimental setup meant to demonstrate a QKD protocol. They have also performed an experiment in collaboration with HRI Allahabad that demonstrates a novel quantum state estimation tool opening up a new paradigm in quantum state estimation.

There were many other research/innovations by scientists of various scientific institutes under the DST. Some of them are enumerated below:

IIT Bombay INSPIRE fellow developing quantum chemistry based software useful for radiation therapy

Dr. Achintya Kumar Dutta from IIT Bombay along with his research group is working to develop new methods for quantum chemistry and implement them in efficient and free software to study electron attachment to aqueous DNA which has big implications in radiation therapy-based treatment of cancer. This study can help in the development of a new class of radio-sensitizers, which makes tumor cells more sensitive to radiation therapy and thereby protects the normal cells. Computational modeling can greatly reduce the development cost of new radio-sensitizers, both in terms of money and time.

Scientists from Wadia Institute of Himalayan Geology (WIHG), Dehradun an autonomous research institute for the study of Geology of the Himalaya under the Department of Science and Technology, have found that glaciers in Sikkim are melting at a higher magnitude as compared to other Himalayan regions. The study published in Science of the Total Environment assessed the response of 23 glaciers of Sikkim to climate change for the period of 1991-2015 and revealed that glaciers in Sikkim have retreated and deglaciated significantly from 1991 to 2015. Small-sized glaciers in Sikkim are retreating while larger glaciers are thinning due to climate change. Accurate knowledge of magnitude as well as the direction of glacier changes, as highlighted in the present study, can lead to awareness among common people regarding water supplies and possible glacier hazards, particularly to those communities that are living in close proximity.

International Advanced Centre for Powder Metallurgy & New Materials (ARCI), an autonomous R&D Centre of Department of Science and Technology (DST), has

developed ultrafast laser surface texturing technology, which can improve the fuel efficiency of internal combustion engines.

Starch-based materials developed to stop rapid blood loss during accidents
Scientists from the Institute of Nano Science and Technology (INST), an autonomous institute under the Department of Science & Technology, have developed a starch-based 'hemostat' material that concentrates the natural clotting factors in blood by physically absorbing excess fluid. The product has increased absorption capacity, improved absorption, inexpensive, biocompatible as well as biodegradable.

Groundwater affects Himalayan slip and climate as the mountains dance to its tune

Researchers from Indian Institute of Geomagnetism (IIG), an autonomous institute under the Department of Science & Technology, have found the mighty Himalayas subside and move up depending on the seasonal changes in groundwater. Since Himalayas play a very important role in influencing climate in the Indian subcontinent, the study funded by DST will help in understanding how hydrology affects climate.

ARCI's cost-effective technology can convert solar energy to industrial process heat

Scientists from the International Advanced Research Centre for Powder Metallurgy and New Materials (ARCI), Hyderabad, an autonomous institution under the Department of Science and Technology (DST), have developed a cost-effective solar receiver tube technology for industrial process heat applications. The receiver tube technology developed by the ARCI team efficiently absorbs solar radiation and converts it into heat for the targeted applications, specially in industries. It exhibits high corrosion resistance suitable for Indian weather conditions. **Two patent applications have been filed for this technology**, and an MoU has been signed with M/s. Greenera Energy India Private Limited for technology transfer, which plans to mass-produce the solar receiver tube for wider market absorption.

Black carbon concentration in the Gangotri glacier region increases by 400 times during summer, according to a study. The study suggests agricultural burning and forest fire as the reason behind this seasonal increase. This can trigger glacial melt because of the light-absorbing nature of black carbon. Scientists from Wadia Institute of Himalayan Geology, (WIHG), an autonomous institution under Department of Science & Technology, in a study conducted at Chirbasa station near Gangotri Glacier, for the Year 2016, found that black carbon (BC) concentration in this region has changed drastically during summer. The research led by Dr. P.S. Negi from WIHG was published in the scientific journal Atmospheric Environment.

SCTIMST develops Flow Diverter Stents Technology for the treatment of Aneurysms of brain

Flow diverters have the advantages of being flexible and adaptable to the shape and course of the vessel.

They also promote healing of the vessel wall by removing the constant stress of blood flow on it.

SCTIMST has filed separate patents for the stent and the delivery system. The research team of Sree Chitra Thirunal Institute of Medical Science and Technology (SCTIMST), Thiruvananthapuram, an Institute of National Importance under the Department of Science and Technology has developed an innovative intracranial flow diverter stent for the treatment of aneurysms of the blood vessels of the brain. It is ready for transfer and further testing in animals, followed by human trials.

WIHG reveals 35 thousand-year history of river erosion in Ladakh Himalayas

The study by the WIHG team will help to understand river-borne erosion and sedimentation. Scientists and students from Wadia Institute of Himalayan Geology (WIHG), an autonomous institute under the Department of Science & Technology, Govt. of India studied rivers in Ladakh Himalaya, bringing out 35 thousand-year history of river erosion and identified hotspots of erosion and wide valleys that act as buffer zones. The study showed how rivers in drier Ladakh Himalaya operated in longer time scales and how they responded to varying climate, an understanding of water and sediment routing, which is crucial as the country gears up its infrastructure and develops smart cities.

JNCASR scientists develop a natural product based Alzheimer inhibitor

Scientists from Jawaharlal Nehru Centre For Advanced Scientific Research (JNCASR) an autonomous institute under the Department of Science & Technology (DST), Govt. of India have modified the structure of Berberine, a natural and cheap product similar to curcumin, available commercially, into Ber-D to use as an Alzheimer's inhibitor. Their research work has been published in the scientific journal *iScience*.

NIF boosts new varieties of Anthurium, a flower with high market value, by lady innovator from Kerala

D Vasini Bai, a women innovator from Thiruvananthapuram, Kerala, has developed ten varieties of *Anthurium*, a flower with high market value, by cross-pollination. *Anthurium* (*Anthurium spp.*) is a vast group of beautiful blooming plants available in a wide range of colors. The plants of the varieties are having high demands due to its use as indoor decorative plants. The National Innovation Foundation-India has facilitated mass multiplication and large scale production of four highly demanded varieties through tissue culture technique at the Indian Institute of Horticultural Research (IIHR), Bangalore, for the diffusion of the varieties in similar agroclimatic zones of the country. *Anthurium* is one of the best domestic flowering plants in the world. They are beautiful but also purify the surrounding air and remove harmful airborne chemicals like formaldehyde, ammonia, toluene, xylene, and allergens. Its importance of removing toxic substances from the air, NASA has placed it in the list

of air purifier plants. Anthurium has larger economic importance because of its eye-catching and beautiful inflorescence and fetches a good market price.

New model to predict ionospheric electron density can help communication/navigation

Researchers from Indian Institute of Geomagnetism (IIG), Navi Mumbai, an autonomous institute of the Department of Science & Technology, Govt. of India, have developed a global model to predict the ionospheric electron density with larger data coverage—a crucial need for communication and navigation.

Stable material for organic pseudocapacitor can offer a low-cost scalable energy storage solution

Scientists at the Institute of Nano Science and Technology (INST), Mohali, an autonomous institute under the Department of Science & Technology, Govt. of India, have developed a stable material for pseudocapacitors or supercapacitors which store electrical energy by electron charge transfer. The material can offer a low-cost scalable energy storage solution as an alternative to batteries.

IASST Inspire fellow developing plasmonic semiconductor nanomaterials to remove toxic materials from water

Biswajit Choudhury working as an Assistant Professor at the Institute of Advanced Study in Science and Technology Assam is exploring ways to develop plasmonic semiconductor nanomaterials (which are metal-like materials with free electrons on the surface that oscillate collectively when hit by light) for removal of toxic organic compounds from water by harvesting solar light. He is utilizing solar light to increase the photocatalytic efficiency of nanomaterials to degrade pollutants as well as generate renewable Hydrogen. In order to achieve this, the recipient of the INSPIRE Faculty Scheme initiated by the Department of Science & Technology, Govt. of India, is trying to understand the science behind the photon accumulation and amplification of incident light by the plasmonic materials for this purpose. Dr. Choudhury who is clustering the disciplines of physics, chemistry, and nanotechnology has published two papers on his current work in *Solar Energy Materials and Solar Cells* (2019, 201, 110053) <https://doi.org/10.1016/j.solmat.2019.110053> and *ACS Sustainable Chemistry and Engineering* (2019, 7, 23, 19295-19302) <https://doi.org/10.1021/acssuschemeng.9b05823> which focus on the use of plasmonic semiconductor nanomaterials for removal of toxic organic compounds from water by harvesting solar light. The materials he is developing can easily adsorb toxic ions like arsenic and fluoride, which are often found in water in North East India and convert it to its non-toxic forms when they are exposed to sunlight.

Biofortified carrot variety developed by farmer scientist benefits local farmers

Madhuban Gajar, a biofortified carrot variety with high β -carotene and iron content developed by Shri Vallabhhai Vasrambhai Marvaniya, a farmer scientist from Junagadh district, Gujarat is benefitting more than 150 local farmers in the area. It is being planted in an area of over 200 hectares in Junagadh, and the average yield, which is 40-50 t/ha, has become the main source of income to the local farmers. The variety is being cultivated in more than 1000 hectares of land in Gujarat, Maharashtra, Rajasthan, West Bengal, Uttar Pradesh during the last three years.

Inspire faculty from NIT Srinagar working on marriage of material science & electrochemistry for sustainable energy

Dr. Malik Abdul Wahid from National Institute of Technology (NIT) Srinagar is a recipient of the INSPIRE Faculty award instituted by the Department of Science & Technology, Govt. of India working in the area of energy research towards marriage of material science and electrochemistry to develop sustainable energy and affordable energy sources. His focus is mainly on electrodes and electrolyte material electrochemistry. Along with his collaborators at IISER Pune, Dr. Malik developed a Si-Phosphorene nano-composite material for efficient Si stabilization as an anode in Li-ion battery, which was published in the journal [Sustainable Energy Fuels](#). The obtained material delivers five times more capacity than carbon-based electrodes and can be fully charged in about 15 minutes.

IASST develops electrochemical sensing platform for detecting carcinogenic & mutagenic compounds in food

Institute of Advanced Study in Science and Technology (IASST), Guwahati, has developed an electrochemical sensing platform for detecting carcinogenic or mutagenic compound *N*-nitrosodimethylamine (NDMA) and *N*-nitrosodiethanolamine (NDEA) sometimes found in food items like cured meat, bacon, some cheese, and low-fat milk. It was achieved by developing a modified electrode by immobilizing carbon nanomaterials (carbon dots) in DNA.

IIT Guwahati discovers new ways to prevent memory loss due to Alzheimer

Researchers at Indian Institute of Technology (IIT) Guwahati has worked on out-of-the-box ideas that can help prevent or reduce short-term memory losses associated with Alzheimer's disease. The IIT Guwahati team reports interesting methods such as application of low-voltage electric field, and the use of 'trojan peptides' to arrest aggregation of neurotoxic molecules in the brain. The scientists are assisted by research scholars Dr. Gaurav Pandey and Mr. JahnuSaikia in their work. The results of their studies have been published in reputed journals such as ACS Chemical Neuroscience, RSC Advances of Royal Society of Chemistry, BBA and Neuropeptides. The development of a cure for Alzheimer's disease assumes importance India as it has the third highest number of Alzheimer's patients in the world, after China and US, with more than four million people falling prey to the memory loss associated with it.

JNCASR Professor elected as International Honorary Member to the American

Academy of Arts and Sciences

Professor Shobhana Narasimhan from the Theoretical Sciences Unit (TSU) at the Jawaharlal Nehru Centre for Advanced Scientific Research (JNCASR), an autonomous institute under the Department of Science & Technology, has been elected as an International Honorary Member to the American Academy of Arts and Sciences. The American Academy of Arts and Sciences honours scholars and leaders who have distinguished themselves in the sciences, arts, humanities and public life. The list of previous International Honorary Members includes Charles Darwin, Albert Einstein and Nelson Mandela. Prof Narasimhan heads the Computational Nanoscience group at JNCASR. She has done significant work on the rational design of nanomaterials, examining how the lowering of dimensionality and reduction of size affect material properties.

RRI comes up with simulation toolkit to ensure safety in secure quantum communication platforms

The recent advisories by the Ministry of Home Affairs to ensure online communication via secure platforms have highlighted the increasing need for measures to ensure security in the virtual world as Covid-19 confines most day to day activities to the digital space. To tackle this challenge, researchers from Raman Research Institute (RRI), an autonomous institute of the Department of Science & Technology (DST), Government of India have come up with a unique simulation toolkit for end-to-end QKD simulation named as 'qkdSim', which is based on modular principles that allow it to be grown to different classes of protocols using various underpinning technologies.

Scientists detect ionospheric irregularities during major space weather events that influence communication & navigation systems

A multi-instrument based ionospheric study of space weather storms over India by the Scientists from the Indian Institute of Geomagnetism (IIG) an autonomous institute under the Department of Science & Technology (DST) have found that the occurrence of equatorial spread F (ESF) irregularities and GPS scintillations are significantly affected by the geomagnetic storms depending upon the time of the onset of the geomagnetic storm. In this present study conducted by Dr. Ram Singh under the guidance of Dr. S. Sripathi from IIG, the coupling of high latitude electric fields, winds, and traveling ionospheric disturbances (TIDs) on the equatorial and low latitude ionosphere were investigated during three major space weather events that occurred on 17th March, 23 June, and 20 December 2015.

New information on atmospheric turbulence parameters of Himalaya region can help weather prediction

Preventing the air traffic disasters may now be easier and weather predictions more

certain, especially in the Himalaya region. Thanks to certain atmospheric turbulence parameters specific to the Himalaya region that scientists have calculated. Scientists at the Aryabhata Research Institute of Observational Sciences (ARIES), an autonomous institute under the Department of Science & Technology (DST), Govt. of India, have estimated turbulence parameters in the lower troposphere over the central Himalayan region for the first time.

<https://dst.gov.in/new-information-atmospheric-turbulence-parameters-himalaya-region-can-help-weather-prediction>

Asian elephant cubs show handedness in trunk behaviour earlier than adult usage of trunks

Asian elephant calves offer an interesting system to study the development of behaviour. They are born with a well-developed sensory system technically called precocial and are capable of locomotion hours after birth. However, they are dependent on their mothers for nutrition, physical protection, and social support for a prolonged period, allowing them ample time and opportunity to learn and perfect the skills necessary for independent survival. The calves can walk soon after birth but are incapable of using their trunk to pick up objects and pull grass.

Trying to probe the peculiarity of behaviour of elephants which stands out against many precocial species, researchers from Jawaharlal Nehru Centre for Advanced Scientific Research (JNCASR) an autonomous institute of the Department of Science & Technology, Government of India found that though their trunks take time to develop adult-like usage, they develop handedness (right or left-side bias) in trunk usage quite early. The study was published recently in the 'International Journal of Developmental Biology'.

<https://dst.gov.in/asian-elephant-cubs-show-handedness-trunk-behaviour-earlier-adult-usage-trunks>

Low-cost supercapacitor from industrial waste cotton & natural seawater electrolyte can help energy storage

Scientists at the International Advanced Research Centre for Powder Metallurgy and New Materials (ARCI), an autonomous organization of the Department of Science and Technology, Govt. of India have developed a simple, low-cost, environmentally friendly, and sustainable supercapacitor electrode derived from industrial waste cotton which can be used as an energy harvester storage device. For the first time, natural seawater is explored as an environmentally friendly, cost-effective, scalable, and alternative aqueous electrolyte, which may replace the existing aqueous-based electrolytes for the economic fabrication of supercapacitor. Supercapacitor is a next-generation energy storage device that has received extensive research attention owing to advantages such as high power density, long durability, and ultrafast charging characteristic as compared to conventional capacitors and lithium-ion batteries (LIB).

<https://dst.gov.in/low-cost-supercapacitor-industrial-waste-cotton-natural-seawater-electrolyte-can-help-energy-storage>

Bengaluru Scientists develop smart switchable window that can 'fog' on demand

Scientists from the Centre for Nano and Soft Matter Sciences (CeNS), Bengaluru have developed an electrically switchable device that can be flipped between transparent and translucent modes. The device titled 'Fog on-demand' was developed by Dr S. Krishna Prasad and his group from CeNS, Bengaluru, an autonomous Science & technology Institute under Department of Science & Technology. It can be changed from transparent to scattering states by the application of an electric field and would be useful as screens for windows along with applications in household, healthcare, privacy creation, smart displays, and saving energy. Currently, the inventors are in dialogue with a Bangalore-based industry to carry out the field tests of the basic design of this device.

<https://dst.gov.in/sites/default/files/Bengaluru%20Scientists%20develop%20smart%20switchable%20window%20that%20can%20%E2%80%98fog%E2%80%99%20on%20demand.pdf>

First indigenous Petcoke-based high energy supercapacitor developed by ARCI would benefit EV industry

The first indigenous Petcoke-based 1200 F supercapacitor device has been developed with the help of high performance porous activated carbon electrodes, a move that would be commercially attractive for Electric Vehicles (EVs) industry. The indigenous supercapacitor device developed by a team of scientists and engineers at International Advanced Research Centre for Powder Metallurgy and New Materials (ARCI), an autonomous institute under the Department of Science & Technology (DST), Govt of India with petroleum coke (petcoke) from *Hindustan Petroleum Corporation Limited (HPCL)* is at par with a world-class commercial supercapacitors in performance.

<https://dst.gov.in/first-indigenous-petcoke-based-high-energy-supercapacitor-developed-arci-would-benefit-ev-industry>

INST efforts to make magnetic hyperthermia-mediated cancer therapy as desired therapy for inoperable tumours

Magnetic hyperthermia-mediated cancer therapy (MHCT), a non-invasive cancer treatment technique involves the delivery and localisation of magnetic materials within

the targeted tumour site followed by subsequent application of an alternating magnetic field (AMF), thereby generating heat at the tumour site. It can efficiently act against deep-seated inaccessible solid tumours like glioblastoma and is highly thermo-sensitive towards normal cells with minimal toxicity against healthy counterparts. Scientists are on the lookout for new materials which can make this treatment more efficient.

Scientists from Institute of Nano Science & Technology an autonomous institute of Department of Science and Technology (DST), Government of India have synthesised different magnetic nano-transducers like Stevioside-coated magnetite nanoparticles; Citric acid-coated Magnetic nanoclusters and Manganese and Zinc doped magnetite nanoparticles for successful application as magnetic hyperthermia agents for cancer therapy.

<https://dst.gov.in/inst-efforts-make-magnetic-hyperthermia-mediated-cancer-therapy-desired-therapy-inoperable-tumours>

INST scientists develop simple economical nonsurgical prevention of cataract

Cataract a major form of blindness that occurs when the structure of crystallin proteins that make up the lens in our eyes deteriorates, causing damaged or disorganised proteins to aggregate and form a milky blue or brown layer, which ultimately affects lens transparency. Thus, prevention of the formation of these aggregates as well as their destruction in the early stage of disease progression is a major treatment strategy for cataracts, and materials that can carry out this task could make cataract prevention affordable and accessible.

A team of scientists from the Institute of Nano Science & Technology (INST) an autonomous institute under the Department of Science & Technology, Government of India has developed nanorods from the nonsteroidal anti-inflammatory drug (NSAID) Aspirin, a popular medication used to reduce pain, fever, or inflammation and found it to be an effective non-invasive small molecule-based nanotherapeutics against cataract.

<https://dst.gov.in/inst-scientists-develop-simple-economical-nonsurgical-prevention-cataract>

Shadesmart & Radiant Cooling technologies supported by DST promotes energy-efficient cooling in buildings

Indian building sector has realized the importance of energy efficiency; it is yet to be effectively integrated in the construction industry. Smart, dynamic shading devices to keep rooms cool in climate zones and latitudes of India and low energy technologies for air-conditioning can help progress towards energy efficiency in the country, a large part of which experiences high-temperature conditions.

The Energy and Resources Institute (TERI) in partnership with the Department of Science & Technology, Government of India has developed novel external shading

solution for windows in residential and commercial buildings under the project Habitat Model for Efficiency and Comfort. The shading system named as “ShadeSmart” has been developed as an innovative and cost-effective solution for achieving indoor comfort with reduced electricity consumption in air conditioning and lighting.

<https://dst.gov.in/shadesmart-radiant-cooling-technologies-supported-dst-promotes-energy-efficient-cooling-buildings>

SNBNCBS develops a No-touch & Painless device for non-invasive screening of bilirubin level in new-borns

Careful screening of bilirubin level in new-borns is mandatory as per American Academy of Paediatrics (2004), to reduce incidents of a type of brain damage called kernicterus that can result from high levels of bilirubin in a baby's blood. Although invasive capillary collection of blood and the subsequent biochemical test is considered a gold standard for jaundice detection in neonates, transcutaneous bilirubin measurement using non-invasive instruments has obvious added advantages.

The device called “AJO-Neo” is developed by Professor Samir K. Pal & his group at S.N. Bose National Centre For Basic Sciences (SNBNCBS), Kolkata, an autonomous research Institute under the Department of Science and Technology (DST), Government of India. The institute is also hosting one of the Technical Research Centres (TRC) funded by DST and in scientific collaboration with Nil-Ratan Sircar (NRS) Medical College and Hospital, Kolkata. The operation of the device is based on non-contact and non-invasive spectrometry-based techniques for measurement of neonatal bilirubin level as an alternative of total serum bilirubin (TSB) test without limitations of other available bilirubin meters.

<https://dst.gov.in/snbncbs-develops-no-touch-painless-device-non-invasive-screening-bilirubin-level-new-borns>

IIA scientists model to redraw co-evolution of the black hole and galaxy and stellar capture scenarios

Researchers from the Indian Institute of Astrophysics (IIA), Bangalore, an autonomous institute of the Department of Science & Technology, Government of India, have modeled the evolution of this relation which can help building demographics of the Black Holes and scenarios involving stellar capture.

The study on cosmic spin and mass evolution of black holes by D. Bhattacharyya and A. Mangalam, from IIA which has been published in the Astrophysical Journal, 2020 can help chalk out black hole archaeology, where one can look into the past and redraw the black hole properties at the formation from the present-day values as

initial conditions, and also estimate SMBH seed properties at formation from stellar-mass black holes via the stellar capture process.

<https://dst.gov.in/iia-scientists-model-redraw-co-evolution-black-hole-and-galaxy-and-stellar-capture-scenarios>

[Please CLICK HERE for details of Success stories.](#)

NB/KGS/(DST Media Cell)

Major Highlights:20 Major Success Stories of DST in 2020

The major challenges that 2020 put before the world helped India emerge as a forerunner in underscoring the critical role of science and technology in bringing positive transformations for a safe, secure, better society well prepared for the future. The country pole-vaulted into one of the top nations in science & technology indices and reached laudable positions in several domains of science technology and innovations.

The year 2020 has been the 'Year of Science' when the best of humanity has shone through the gloom that descended upon us due to the COVID19 pandemic. It is a matter of record that as the spread of the disease accelerated, so did the research efforts to mitigate this.-Minister for Science & Technology, Earth Sciences, Health & Family Welfare Dr. Harsh Vardhan

Science and technology is one of the most powerful departments of the country for solving all kinds of problems - agriculture, potable water, energy, health and so on. -- Minister for Science & Technology, Earth Sciences, Health & Family Welfare Dr. Harsh Vardhan

Science and Technology are the strongest foundations on which the future can be built. India is progressing rapidly towards self reliance by connecting the invention ecosystem to the innovation ecosystem with democratisation and diversity of science becoming the drivers of development.--Secretary, Department Of Science & Technology, Professor Ashutosh Sharma

India is placed 3rd among countries in scientific publication as per NSF database. The country has featured within the top 50 innovative economies globally (at 48th rank), as per Global Innovation Index (GII). It has also reached 3rd Position in terms of no of PhDs, in size of Higher Education System; as well as in terms of No of Startups.

India has emerged as an inevitable member of leading international scientific coalitions— notably, global efforts in vaccine research, development and supply, and global partnership on artificial intelligence (GPAI) to name a few. India was elected as Chair of the World Health Organization’s (WHO) executive board which is a yet another remarkable achievement and recognition of India’s S&T prowess.

The draft of the 5th National Science Technology and Innovation Policy has been finalized and is now available for public consultation. The policy drafted through a 4 track process of consultations during last 6 months aims to bring about profound changes through short, medium and long- term mission mode projects by building an nurtured ecosystem that promotes research and innovation on the part of both individuals and organizations.

It aims to foster, develop, and nurture a robust system for evidence and stakeholder-driven STI planning, information, evaluation, and policy research in India. The objective of the policy is to identify and address strengths and weaknesses of the Indian STI ecosystem to catalyse socio-economic development of the country and also make the Indian STI ecosystem globally competitive.

‘Science’ and ‘Science-Advice’ became the core of decision making. The share of scientific and science-informed debates in mainstream media jumped manifold, and the confidence of general population and trust in Science & Technology increased significantly.

Seamless industry-academia collaborations and inter-disciplinary partnerships led to quicker solutions and products in an energised STI ecosystem in 2020.

The National Initiative for Developing and Harnessing Innovation (NIDHI) made some major impacts on India’s Innovation ecosystem by nurturing 3,681 startups through a network of 153 incubators created by DST, which generated 65,864 jobs as cumulative direct employment, created a wealth of Rs 27,262 crores and generated 1,992 intellectual property.

The “Million Minds Augmenting National Aspirations and Knowledge (MANAK)” programme brought 3.8 mn ideas from middle and high schools across the country, out of which some brilliant ones have been shortlisted for showcasing at district, state and then at the National Level Exhibition & Project Competition.

The collective strength and power of NIDHI, its incubator network and its startups was tested successfully during the COVID-19 pandemic through the **“Centre for Augmenting WAR with COVID-19 Health Crisis (CAWACH)”** program by supporting various solutions to resolve the crisis. The efforts of CAWACH to scout, evaluate and support the innovations and startups that address COVID-19 challenges led to a slew of technologies, diagnostics & drugs, disinfectants & sanitizers, ventilators & medical equipment, PPEs and informatics as solutions to contain, treat and manage the pandemic.

India National Supermodel Committee predicted the rise and fall of the pandemic over time. The modelling study called the 'COVID-19 India National Supermodel' deduced that India passed its COVID-19 peak in September and, if current trends continue, there will be 'minimal cases' by February.

However, they warned that there is no place for complacency and existing personal safety protocols need to continue in full measure. The deduction is the result of analysis by an expert committee consisting of mathematicians and epidemiologists.

The National Super Computing Mission (NSM) is rapidly boosting High-Performance Computing (HPC) in the country to meet the increasing computational demands of academia, researchers, MSMEs, and startups in oil exploration, flood prediction, genomics, and drug discovery. Param Shivay, the first supercomputer assembled indigenously, was installed in IIT (BHU), followed by Param Shakti and Param Brahma at IIT-Kharagpur and IISER, Pune, respectively. Thereafter facilities were set up in two more institutions, and MoUs signed for providing it to 13 institutions. Param Siddhi the high-performance computing-artificial intelligence (HPC-AI) achieved global ranking of 63 among the top 500 most powerful non-distributed computer systems.

Sophisticated Analytical & Technical Help Institutes (SATHI) centres to house major analytical instruments have been established to provide common services of high-end analytical testing, thus reducing dependency on foreign sources. The ST has set up three such centres—at IIT Kharagpur, IIT Delhi and BHU under the SATHI programme which are being operated with a transparent, open-access policy to make professionally managed, S&T infrastructure readily accessible to academia, start-ups, industry and R&D labs. Five SATHI centres every year have been planned for the next four years.

New S&T areas of Cyberphysical systems like AI, Robotics, IOT receive big boost with the launch of the National Mission on Interdisciplinary Cyber-Physical Systems (ICPS). Its unique architecture of 25 innovation hubs and parks set up across the country is bringing about strong collaboration and co-ownership among industry, academia, and government, connecting them with full flexibility.

Three Centres of Excellence (CoE) were established in Himalayan Universities in Kashmir, and North Eastern States of Sikkim & Assam to lead climate change research. Research on monsoons, aerosols, glacial lake outburst floods saw significant publications. A study published in journal Science showed planetary wave from the North Atlantic is capable of derailing the Indian monsoon. Research published in the journal Atmospheric Chemistry and Physics' showed that aerosols increased incidents of high rainfall in the Himalayan foothills.

12. CELEBRATION OF SCIENCE INVITES ATTENTION OF TOP DIGNITARIES

President of India Ram Nath Kovind announced three key initiatives for gender advancement and equality in academic and research institutions on occasion and

conferred national awards for science communication and popularization, including women excellence awards.

President of India graced the celebration of the National Science Day (NSD) for the first time. NSD is celebrated on 28th February to commemorate the announcement of the discovery of the 'Raman Effect' by Sir C.V. Raman for which he was awarded the Nobel Prize in 1930.

Gender Advancement for Transforming Institutions (GATI), an innovative pilot project launched by the DST ushered a novel intervention for promoting gender equity in science and technology. It nudges institutions of higher education and research towards supporting diversity, inclusion and the full spectrum of talent for their own success and progression. In particular, it aspires to create an enabling environment for equal participation of women in Science, Technology, Engineering, Medicine and Mathematics (STEMM) disciplines at all levels.

14. SRI CHITRA'S PROACTIVE EFFORTS HELP COMBAT THE PANDEMIC

Sree Chitra Tirunal Institute for Medical Sciences and Technology (SCTIMST) brought out several technologies and products that could be crucial to combat the diseases.

It's one step confirmatory diagnostic kit for COVID 19 that responded to India's urgent need for rapid testing. The other R&D work on the issue included a UV Based Facemask Disposal Bin, which can be used by health workers in hospitals and in public places for decontamination of used facemask, overhead covers and face shields, a superabsorbent material for liquid respiratory and other body fluid solidification and disinfection for the safe management of infected respiratory secretions.

15. SURVEY OF INDIA LAUNCHED PAN INDIA HIGHRESOLUTION GEOSPATIAL MAPPING

The Survey of India (Sol), a subordinate department under the Department of Science & Technology has embarked on a pan-India geospatial mapping of the country at a very high resolution of 10 cm scale using most advanced technologies like drone technology. With this, India joins the select club of few nations to have Ultra High-resolution National Topographic Data as foundation data.

This effort has been launched in three States -- Haryana, Maharashtra, and Karnataka and also for the Ganga basin. Sol has undertaken mapping of the Village Gaothan (Aabadi) areas in Maharashtra, covering more than 40,000 villages. Drone-based mapping for five districts of the state of Karnataka for the revenue department, including the village, semiurban and urban areas, and LSM mapping for the complete state of Haryana has also been undertaken.

Drone survey will be pivotal to fix locations of village boundaries, canals, canal limits,

agriculture field limits, and roads in these villages.

Sol has also launched web portals to facilitate the access of the digital map or data to every citizen of the country and help centre and state organizations in decision making, planning, monitoring, and governance. Sol has also provided a free to use mobile app, "SAHYOG".

16. SERB LAUNCHES POWER FOR WOMEN RESEARCHERS

Science and Engineering Research Board (SERB), a Statutory body of the Department of Science and Technology (DST), Government of India, initiated a Scheme to mitigate gender disparity in science and engineering research funding in Indian academic institutions and R&D laboratories. A well-thought-out Scheme titled "SERB-POWER (Promoting Opportunities for Women in Exploratory Research)" has been designed exclusively for women scientists and was launched on 29 October 2020. SERB-POWER promotes women researchers in regular service in academic and research institutions to take up R&D at the highest level through two categories of research support, namely, SERB – POWER Fellowship and SERB – POWER Research Grants.

SERB – Power Fellowship offers a personal Fellowship and a research grant to top performing women researchers for a period of three years, while SERB – Power Research Grants ensure funding to undertake highly impactful research across all disciplines of S&T. Call for projects for this program is already announced.

17. PHENOMENAL WHITE PAPER BY TIFAC PROVIDED RECOMMENDATIONS FOR FOCUSED INTERVENTIONS FOR 'MAKE IN INDIA AFTER THE COVID 19 PANDEMIC

A phenomenal white paper on "Focused Interventions for 'Make in India': Post COVID 19" prepared by Technology Information, Forecasting and Assessment Council (TIFAC) provided recommendations for giving immediate technology and policy impetus to make India "ATMANIRBHAR," specially in the aftermath of the pandemic. It captured sector-specific strengths, market trends, and opportunities in five sectors, critical from the country's perspective, including healthcare, machinery, ICT, agriculture, manufacturing, and electronics with reference to supply and demand, self-sufficiency, and mass-scale production capacity. It has identified policy options primarily in the public health system, MSME sector, global relations: FDI, recalibrated trade alignments, new-age technologies, etc.

18. SCIENTISTS FROM IIA & ARIES COLLABORATED WITH NOBEL LAUREATE ON TMT

Indian astronomers have worked with 2020 Physics Nobel Laureate Prof. Andrea Ghez on the design of backend instruments and possible science prospects of the Thirty Meter Telescope (TMT) project being installed at Maunakea in Hawaii which can revolutionize the understanding of the universe and the enigmas in it. Scientists from the Indian Institute of Astrophysics (IIA) and Aryabhata Research Institute of

Observational Sciences (ARIES) have collaborated with Prof. Ghez in the ongoing research and developmental activities of the TMT project.

19. BSIP SCALES UP COVID TESTING FACILITIES, BECOMING THE TOP INSTITUTION THROUGHOUT THE COUNTRY IN TERMS OF AVERAGE PROCESSING TIME OF SAMPLES

BSIP joined hands with the Government of Uttar Pradesh to combat COVID-19 in the state, becoming one of the five Central Government research institutes in Lucknow, which took initial steps to start laboratory testing of COVID-19. With 1000 to 1200 samples being tested per day, BSIP is the top institution not only in the state but throughout the country in terms of the average processing time of samples.

20. RRI ACHIEVES FIRST SUCCESSFUL IMPLEMENTATION OF A HIGHLY SECURE EFFICIENT QUANTUM CRYPTOGRAPHIC SCHEME

The QulC lab at RRI achieved the first successful implementation in India of a highly secure efficient Quantum Cryptographic scheme for an end to end free space QKD under the RRI-ISRO project on “Quantum Experiments using Satellite Technology”. The lab has also come up with an end-to-end simulation toolkit named as “qkdSim” to ensure safety in secure quantum communication platforms, a first of its kind that enables Quantum Key Distribution Protocol (QKD) experimentalists to obtain a realistic estimate of the result from an experimental setup meant to demonstrate a QKD protocol. They have also performed an experiment in collaboration with HRI Allahabad that demonstrates a novel quantum state estimation tool opening up a new paradigm in quantum state estimation.

There were many other research/innovations by scientists of various scientific institutes under the DST. Some of them are enumerated below:

IIT Bombay INSPIRE fellow developing quantum chemistry based software useful for radiation therapy

Dr. Achintya Kumar Dutta from IIT Bombay along with his research group is working to develop new methods for quantum chemistry and implement them in efficient and free software to study electron attachment to aqueous DNA which has big implications in radiation therapy-based treatment of cancer. This study can help in the development of a new class of radio-sensitizers, which makes tumor cells more sensitive to radiation therapy and thereby protects the normal cells. Computational modeling can greatly reduce the development cost of new radio-sensitizers, both in terms of money and time.

Scientists from Wadia Institute of Himalayan Geology (WIHG), Dehradun an autonomous research institute for the study of Geology of the Himalaya under the Department of Science and Technology, have found that glaciers in Sikkim are melting at a higher magnitude as compared to other Himalayan regions. The study published in Science of the Total Environment assessed the response of 23 glaciers of Sikkim to climate change for the period of 1991-2015 and revealed that glaciers in

Sikkim have retreated and deglaciated significantly from 1991 to 2015. Small-sized glaciers in Sikkim are retreating while larger glaciers are thinning due to climate change. Accurate knowledge of magnitude as well as the direction of glacier changes, as highlighted in the present study, can lead to awareness among common people regarding water supplies and possible glacier hazards, particularly to those communities that are living in close proximity.

International Advanced Centre for Powder Metallurgy & New Materials (ARCI), an autonomous R&D Centre of Department of Science and Technology (DST), has developed ultrafast laser surface texturing technology, which can improve the fuel efficiency of internal combustion engines.

Starch-based materials developed to stop rapid blood loss during accidents
Scientists from the Institute of Nano Science and Technology (INST), an autonomous institute under the Department of Science & Technology, have developed a starch-based 'hemostat' material that concentrates the natural clotting factors in blood by physically absorbing excess fluid. The product has increased absorption capacity, improved absorption, inexpensive, biocompatible as well as biodegradable.

Groundwater affects Himalayan slip and climate as the mountains dance to its tune

Researchers from Indian Institute of Geomagnetism (IIG), an autonomous institute under the Department of Science & Technology, have found the mighty Himalayas subside and move up depending on the seasonal changes in groundwater. Since Himalayas play a very important role in influencing climate in the Indian subcontinent, the study funded by DST will help in understanding how hydrology affects climate.

ARCI's cost-effective technology can convert solar energy to industrial process heat

Scientists from the International Advanced Research Centre for Powder Metallurgy and New Materials (ARCI), Hyderabad, an autonomous institution under the Department of Science and Technology (DST), have developed a cost-effective solar receiver tube technology for industrial process heat applications. The receiver tube technology developed by the ARCI team efficiently absorbs solar radiation and converts it into heat for the targeted applications, specially in industries. It exhibits high corrosion resistance suitable for Indian weather conditions. **Two patent applications have been filed for this technology**, and an MoU has been signed with M/s. Greenera Energy India Private Limited for technology transfer, which plans to mass-produce the solar receiver tube for wider market absorption.

Black carbon concentration in the Gangotri glacier region increases by 400 times during summer, according to a study. The study suggests agricultural burning and forest fire as the reason behind this seasonal increase. This can trigger glacial melt

because of the light-absorbing nature of black carbon. Scientists from Wadia Institute of Himalayan Geology, (WIHG), an autonomous institution under Department of Science & Technology, in a study conducted at Chirbasa station near Gangotri Glacier, for the Year 2016, found that black carbon (BC) concentration in this region has changed drastically during summer. The research led by Dr. P.S. Negi from WIHG was published in the scientific journal Atmospheric Environment.

SCTIMST develops Flow Diverter Stents Technology for the treatment of Aneurysms of brain

Flow diverters have the advantages of being flexible and adaptable to the shape and course of the vessel.

They also promote healing of the vessel wall by removing the constant stress of blood flow on it.

SCTIMST has filed separate patents for the stent and the delivery system. The research team of Sree Chitra Thirunal Institute of Medical Science and Technology (SCTIMST), Thiruvananthapuram, an Institute of National Importance under the Department of Science and Technology has developed an innovative intracranial flow diverter stent for the treatment of aneurysms of the blood vessels of the brain. It is ready for transfer and further testing in animals, followed by human trials.

WIHG reveals 35 thousand-year history of river erosion in Ladakh Himalayas

The study by the WIHG team will help to understand river-borne erosion and sedimentation. Scientists and students from Wadia Institute of Himalayan Geology (WIHG), an autonomous institute under the Department of Science & Technology, Govt. of India studied rivers in Ladakh Himalaya, bringing out 35 thousand-year history of river erosion and identified hotspots of erosion and wide valleys that act as buffer zones. The study showed how rivers in drier Ladakh Himalaya operated in longer time scales and how they responded to varying climate, an understanding of water and sediment routing, which is crucial as the country gears up its infrastructure and develops smart cities.

JNCASR scientists develop a natural product based Alzheimer inhibitor

Scientists from Jawaharlal Nehru Centre For Advanced Scientific Research (JNCASR) an autonomous institute under the Department of Science & Technology (DST), Govt. of India have modified the structure of Berberine, a natural and cheap product similar to curcumin, available commercially, into Ber-D to use as an Alzheimer's inhibitor. Their research work has been published in the scientific journal iScience.

NIF boosts new varieties of Anthurium, a flower with high market value, by lady innovator from Kerala

D Vasini Bai, a women innovator from Thiruvananthapuram, Kerala, has developed ten varieties of *Anthurium*, a flower with high market value, by cross-pollination.

Anthurium (*Anthurium spp.*) is a vast group of beautiful blooming plants available in a wide range of colors. The plants of the varieties are having high demands due to its use as indoor decorative plants. The National Innovation Foundation-India has facilitated mass multiplication and large scale production of four highly demanded varieties through tissue culture technique at the Indian Institute of Horticultural Research (IIHR), Bangalore, for the diffusion of the varieties in similar agroclimatic zones of the country. Anthurium is one of the best domestic flowering plants in the world. They are beautiful but also purify the surrounding air and remove harmful airborne chemicals like formaldehyde, ammonia, toluene, xylene, and allergens. Its importance of removing toxic substances from the air, NASA has placed it in the list of air purifier plants. Anthurium has larger economic importance because of its eye-catching and beautiful inflorescence and fetches a good market price.

New model to predict ionospheric electron density can help communication/navigation

Researchers from Indian Institute of Geomagnetism (IIG), Navi Mumbai, an autonomous institute of the Department of Science & Technology, Govt. of India, have developed a global model to predict the ionospheric electron density with larger data coverage—a crucial need for communication and navigation.

Stable material for organic pseudocapacitor can offer a low-cost scalable energy storage solution

Scientists at the Institute of Nano Science and Technology (INST), Mohali, an autonomous institute under the Department of Science & Technology, Govt. of India, have developed a stable material for pseudocapacitors or supercapacitors which store electrical energy by electron charge transfer. The material can offer a low-cost scalable energy storage solution as an alternative to batteries.

IASST Inspire fellow developing plasmonic semiconductor nanomaterials to remove toxic materials from water

Biswajit Choudhury working as an Assistant Professor at the Institute of Advanced Study in Science and Technology Assam is exploring ways to develop plasmonic semiconductor nanomaterials (which are metal-like materials with free electrons on the surface that oscillate collectively when hit by light) for removal of toxic organic compounds from water by harvesting solar light. He is utilizing of solar light to increase the photocatalytic efficiency of nanomaterials to degrade pollutants as well as generate renewable Hydrogen. In order to achieve this, the recipient of the INSPIRE Faculty Scheme initiated by the Department of Science & Technology, Govt. of India, is trying to understand the science behind the photon accumulation and amplification of incident light by the plasmonic materials for this purpose. Dr. Choudhury who is clustering the disciplines of physics, chemistry, and nanotechnology has published two papers on his current work in *Solar Energy Materials and Solar Cells* (2019, 201, 110053)

<https://doi.org/10.1016/j.solmat.2019.110053> and ACS Sustainable Chemistry and Engineering (2019, 7, 23, 19295-19302) <https://doi.org/10.1021/acssuschemeng.9b05823> which focus on the use of plasmonic semiconductor nanomaterials for removal of toxic organic compounds from water by harvesting solar light. The materials he is developing can easily adsorb toxic ions like arsenic and fluoride, which are often found in water in North East India and convert it to its not toxic forms when they are exposed to sunlight.

Biofortified carrot variety developed by farmer scientist benefits local farmers

Madhuban Gajar, a biofortified carrot variety with high β -carotene and iron content developed by Shri Vallabhbhai Vasrambhai Marvaniya, a farmer scientist from Junagadh district, Gujarat is benefitting more than 150 local farmers in the area. It is being planted in an area of over 200 hectares in Junagadh, and the average yield, which is 40-50 t/ha, has become the main source of income to the local farmers. The variety is being cultivated in more than 1000 hectares of land in Gujarat, Maharashtra, Rajasthan, West Bengal, Uttar Pradesh during the last three years.

Inspire faculty from NIT Srinagar working on marriage of material science & electrochemistry for sustainable energy

Dr. Malik Abdul Wahid from National Institute of Technology (NIT) Srinagar is a recipient of the INSPIRE Faculty award instituted by the Department of Science & Technology, Govt. of India working in the area of energy research towards marriage of material science and electrochemistry to develop sustainable energy and affordable energy sources. His focus is mainly on electrodes and electrolyte material electrochemistry. Along with his collaborators at IISER Pune, Dr. Malik developed a Si-Phosphorene nano-composite material for efficient Si stabilization as an anode in Li-ion battery, which was published in the journal [Sustainable Energy Fuels](#). The obtained material delivers five times more capacity than carbon-based electrodes and can be fully charged in about 15 minutes.

IASST develops electrochemical sensing platform for detecting carcinogenic & mutagenic compounds in food

Institute of Advanced Study in Science and Technology (IASST), Guwahati, has developed an electrochemical sensing platform for detecting carcinogenic or mutagenic compound *N*-nitrosodimethylamine (NDMA) and *N*-nitrosodiethanolamine (NDEA) sometimes found in food items like cured meat, bacon, some cheese, and low-fat milk. It was achieved by developing a modified electrode by immobilizing carbon nanomaterials (carbon dots) in DNA.

IIT Guwahati discovers new ways to prevent memory loss due to Alzheimer

Researchers at Indian Institute of Technology (IIT) Guwahati has worked on out-of-the-box ideas that can help prevent or reduce short-term memory losses associated with Alzheimer's disease. The IIT Guwahati team reports interesting methods such as application of low-voltage electric field, and the use of 'trojan peptides' to arrest

aggregation of neurotoxic molecules in the brain. The scientists are assisted by research scholars Dr. Gaurav Pandey and Mr. JahnuSaikia in their work. The results of their studies have been published in reputed journals such as ACS Chemical Neuroscience, RSC Advances of Royal Society of Chemistry, BBA and Neuropeptides. The development of a cure for Alzheimer's disease assumes importance India as it has the third highest number of Alzheimer's patients in the world, after China and US, with more than four million people falling prey to the memory loss associated with it.

JNCASR Professor elected as International Honorary Member to the American Academy of Arts and Sciences

Professor Shobhana Narasimhan from the Theoretical Sciences Unit (TSU) at the Jawaharlal Nehru Centre for Advanced Scientific Research (JNCASR), an autonomous institute under the Department of Science & Technology, has been elected as an International Honorary Member to the American Academy of Arts and Sciences. The American Academy of Arts and Sciences honours scholars and leaders who have distinguished themselves in the sciences, arts, humanities and public life. The list of previous International Honorary Members includes Charles Darwin, Albert Einstein and Nelson Mandela. Prof Narasimhan heads the Computational Nanoscience group at JNCASR. She has done significant work on the rational design of nanomaterials, examining how the lowering of dimensionality and reduction of size affect material properties.

RRI comes up with simulation toolkit to ensure safety in secure quantum communication platforms

The recent advisories by the Ministry of Home Affairs to ensure online communication via secure platforms have highlighted the increasing need for measures to ensure security in the virtual world as Covid-19 confines most day to day activities to the digital space. To tackle this challenge, researchers from Raman Research Institute (RRI), an autonomous institute of the Department of Science & Technology (DST), Government of India have come up with a unique simulation toolkit for end-to-end QKD simulation named as 'qkdSim', which is based on modular principles that allow it to be grown to different classes of protocols using various underpinning technologies.

Scientists detect ionospheric irregularities during major space weather events that influence communication & navigation systems

A multi-instrument based ionospheric study of space weather storms over India by the Scientists from the Indian Institute of Geomagnetism (IIG) an autonomous institute under the Department of Science & Technology (DST) have found that the occurrence of equatorial spread *F* (ESF) irregularities and GPS scintillations are significantly affected by the geomagnetic storms depending upon the time of the onset of the geomagnetic storm. In this present study conducted by Dr. Ram Singh under the guidance of Dr. S. Sripathi from IIG, the coupling of high latitude electric

fields, winds, and traveling ionospheric disturbances (TIDs) on the equatorial and low latitude ionosphere were investigated during three major space weather events that occurred on 17th March, 23 June, and 20 December 2015.

New information on atmospheric turbulence parameters of Himalaya region can help weather prediction

Preventing the air traffic disasters may now be easier and weather predictions more certain, especially in the Himalaya region. Thanks to certain atmospheric turbulence parameters specific to the Himalaya region that scientists have calculated. Scientists at the Aryabhata Research Institute of Observational Sciences (ARIES), an autonomous institute under the Department of Science & Technology (DST), Govt. of India, have estimated turbulence parameters in the lower troposphere over the central Himalayan region for the first time.

<https://dst.gov.in/new-information-atmospheric-turbulence-parameters-himalaya-region-can-help-weather-prediction>

Asian elephant cubs show handedness in trunk behaviour earlier than adult usage of trunks

Asian elephant calves offer an interesting system to study the development of behaviour. They are born with a well-developed sensory system technically called precocial and are capable of locomotion hours after birth. However, they are dependent on their mothers for nutrition, physical protection, and social support for a prolonged period, allowing them ample time and opportunity to learn and perfect the skills necessary for independent survival. The calves can walk soon after birth but are incapable of using their trunk to pick up objects and pull grass.

Trying to probe the peculiarity of behaviour of elephants which stands out against many precocial species, researchers from Jawaharlal Nehru Centre for Advanced Scientific Research (JNCASR) an autonomous institute of the Department of Science & Technology, Government of India found that though their trunks take time to develop adult-like usage, they develop handedness (right or left-side bias) in trunk usage quite early. The study was published recently in the 'International Journal of Developmental Biology'.

<https://dst.gov.in/asian-elephant-cubs-show-handedness-trunk-behaviour-earlier-adult-usage-trunks>

Low-cost supercapacitor from industrial waste cotton & natural seawater electrolyte can help energy storage

Scientists at the International Advanced Research Centre for Powder Metallurgy and New Materials (ARCI), an autonomous organization of the Department of Science and Technology, Govt. of India have developed a simple, low-cost, environmentally

friendly, and sustainable supercapacitor electrode derived from industrial waste cotton which can be used as an energy harvester storage device. For the first time, natural seawater is explored as an environmentally friendly, cost-effective, scalable, and alternative aqueous electrolyte, which may replace the existing aqueous-based electrolytes for the economic fabrication of supercapacitor. Supercapacitor is a next-generation energy storage device that has received extensive research attention owing to advantages such as high power density, long durability, and ultrafast charging characteristic as compared to conventional capacitors and lithium-ion batteries (LIB).

<https://dst.gov.in/low-cost-supercapacitor-industrial-waste-cotton-natural-seawater-electrolyte-can-help-energy-storage>

Bengaluru Scientists develop smart switchable window that can ‘fog’ on demand

Scientists from the Centre for Nano and Soft Matter Sciences (CeNS), Bengaluru have developed an electrically switchable device that can be flipped between transparent and translucent modes. The device titled ‘Fog on-demand’ was developed by Dr S. Krishna Prasad and his group from CeNS, Bengaluru, an autonomous Science & technology Institute under Department of Science & Technology. It can be changed from transparent to scattering states by the application of an electric field and would be useful as screens for windows along with applications in household, healthcare, privacy creation, smart displays, and saving energy. Currently, the inventors are in dialogue with a Bangalore-based industry to carry out the field tests of the basic design of this device.

<https://dst.gov.in/sites/default/files/Bengaluru%20Scientists%20develop%20smart%20switchable%20window%20that%20can%20%E2%80%98fog%E2%80%99%20on%20demand.pdf>

First indigenous Petcoke-based high energy supercapacitor developed by ARCI would benefit EV industry

The first indigenous Petcoke-based 1200 F supercapacitor device has been developed with the help of high performance porous activated carbon electrodes, a move that would be commercially attractive for Electric Vehicles (EVs) industry. The indigenous supercapacitor device developed by a team of scientists and engineers at International Advanced Research Centre for Powder Metallurgy and New Materials (ARCI), an autonomous institute under the Department of Science & Technology (DST), Govt of India with petroleum coke (petcoke) from *Hindustan Petroleum Corporation Limited (HPCL)* is at par with a world-class commercial supercapacitors

in performance.

<https://dst.gov.in/first-indigenous-petcoke-based-high-energy-supercapacitor-developed-arci-would-benefit-ev-industry>

INST efforts to make magnetic hyperthermia-mediated cancer therapy as desired therapy for inoperable tumours

Magnetic hyperthermia-mediated cancer therapy (MHCT), a non-invasive cancer treatment technique involves the delivery and localisation of magnetic materials within the targeted tumour site followed by subsequent application of an alternating magnetic field (AMF), thereby generating heat at the tumour site. It can efficiently act against deep-seated inaccessible solid tumours like glioblastoma and is highly thermo-sensitive towards normal cells with minimal toxicity against healthy counterparts. Scientists are on the lookout for new materials which can make this treatment more efficient.

Scientists from Institute of Nano Science & Technology an autonomous institute of Department of Science and Technology (DST), Government of India have synthesised different magnetic nano-transducers like Stevioside-coated magnetite nanoparticles; Citric acid-coated Magnetic nanoclusters and Manganese and Zinc doped magnetite nanoparticles for successful application as magnetic hyperthermia agents for cancer therapy.

<https://dst.gov.in/inst-efforts-make-magnetic-hyperthermia-mediated-cancer-therapy-desired-therapy-inoperable-tumours>

INST scientists develop simple economical nonsurgical prevention of cataract

Cataract a major form of blindness that occurs when the structure of crystallin proteins that make up the lens in our eyes deteriorates, causing damaged or disorganised proteins to aggregate and form a milky blue or brown layer, which ultimately affects lens transparency. Thus, prevention of the formation of these aggregates as well as their destruction in the early stage of disease progression is a major treatment strategy for cataracts, and materials that can carry out this task could make cataract prevention affordable and accessible.

A team of scientists from the Institute of Nano Science & Technology (INST) an autonomous institute under the Department of Science & Technology, Government of India has developed nanorods from the nonsteroidal anti-inflammatory drug (NSAID) Aspirin, a popular medication used to reduce pain, fever, or inflammation and found it to be an effective non-invasive small molecule-based nanotherapeutics against cataract.

<https://dst.gov.in/inst-scientists-develop-simple-economical-nonsurgical-prevention-cataract>

Shadesmart & Radiant Cooling technologies supported by DST promotes

energy-efficient cooling in buildings

Indian building sector has realized the importance of energy efficiency; it is yet to be effectively integrated in the construction industry. Smart, dynamic shading devices to keep rooms cool in climate zones and latitudes of India and low energy technologies for air-conditioning can help progress towards energy efficiency in the country, a large part of which experiences high-temperature conditions.

The Energy and Resources Institute (TERI) in partnership with the Department of Science & Technology, Government of India has developed novel external shading solution for windows in residential and commercial buildings under the project Habitat Model for Efficiency and Comfort. The shading system named as “ShadeSmart” has been developed as an innovative and cost-effective solution for achieving indoor comfort with reduced electricity consumption in air conditioning and lighting.

<https://dst.gov.in/shadesmart-radiant-cooling-technologies-supported-dst-promotes-energy-efficient-cooling-buildings>

SNBNCBS develops a No-touch & Painless device for non-invasive screening of bilirubin level in new-borns

Careful screening of bilirubin level in new-borns is mandatory as per American Academy of Paediatrics (2004), to reduce incidents of a type of brain damage called kernicterus that can result from high levels of bilirubin in a baby's blood. Although invasive capillary collection of blood and the subsequent biochemical test is considered a gold standard for jaundice detection in neonates, transcutaneous bilirubin measurement using non-invasive instruments has obvious added advantages.

The device called “AJO-Neo” is developed by Professor Samir K. Pal & his group at S.N. Bose National Centre For Basic Sciences (SNBNCBS), Kolkata, an autonomous research Institute under the Department of Science and Technology (DST), Government of India. The institute is also hosting one of the Technical Research Centres (TRC) funded by DST and in scientific collaboration with Nil-Ratan Sircar (NRS) Medical College and Hospital, Kolkata. The operation of the device is based on non-contact and non-invasive spectrometry-based techniques for measurement of neonatal bilirubin level as an alternative of total serum bilirubin (TSB) test without limitations of other available bilirubin meters.

<https://dst.gov.in/snbncbs-develops-no-touch-painless-device-non-invasive-screening-bilirubin-level-new-borns>

IIA scientists model to redraw co-evolution of the black hole and galaxy and stellar capture scenarios

Researchers from the Indian Institute of Astrophysics (IIA), Bangalore, an

autonomous institute of the Department of Science & Technology, Government of India, have modeled the evolution of this relation which can help building demographics of the Black Holes and scenarios involving stellar capture.

The study on cosmic spin and mass evolution of black holes by D. Bhattacharyya and A. Mangalam, from IIA which has been published in the Astrophysical Journal, 2020 can help chalk out black hole archaeology, where one can look into the past and redraw the black hole properties at the formation from the present-day values as initial conditions, and also estimate SMBH seed properties at formation from stellar-mass black holes via the stellar capture process.

<https://dst.gov.in/ia-scientists-model-redraw-co-evolution-black-hole-and-galaxy-and-stellar-capture-scenarios>

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